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Agriculture Development Fund

FINAL REPORT

REGIONAL TESTING AND DEVELOPMENT OF WINTER CULTIVARS

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Prepared by: Crop Development Centre
University of Saskatchewan

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FINAL REPORT - AGRICULTURE DEVELOPMENT FUND PROJECT 97000235

REGIONAL TESTING AND DEVELOPMENT OF WINTER WHEAT CULTIVARS

June 30, 2000

Principle Investigator
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AGRICULTURE DEVELOPMENT FUND
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A. ABSTRACT/SUMMARY

This is a continuing project that was started in 1993 and renewed in 1997 and 1998 with the following objectives. 1) To identify winter wheat lines with regional adaptation in Saskatchewan. 2) To conduct final tests required for winter wheat cultivar registration. 3) To develop a database that can be used to provide reliable winter wheat regional cultivar recommendations. 4) To provide regional winter wheat field demonstrations. The current contract started in January 1998.

Cooperative/Regional winter wheat trials and early generation lines were seeded at Elrose, Saskatoon (3 sites), Wadena, Yorkton, Melfort and Indian Head in the fall of each year of this project. Data was collected on winter survival, agronomic performance, disease reaction, and grain quality for each trial in each year. Detailed summaries of the results of these trials have been provided in Crop Development Centre Conservation Production Systems Annual Reports to Saskatchewan Agriculture and in the following reports that were released in December of each year. 1) The Winter Wheat Review for Grain Crops Subcommittee of Sask. Advisory Council on Crops. 2) Report on the Central Hard Red Winter Wheat Co-operative Tests. 3) Report on the Central Hard White Winter Wheat Co-operative Tests. Information on the performance of earlier generation material is available on request. Details on three (CDC Ptarmigan -a soft white and CDC Raptor and CDC Falcon-rust resistant hard red) winter wheat lines that were registered based on data from these trials is also available on request.

B. EXECUTIVE SUMMARY

This is a continuing project that was started in 1993 and renewed in 1997 and 1998 with the following objectives. 1) To identify winter wheat lines with regional adaptation in Saskatchewan. 2) To conduct final tests required for winter wheat cultivar registration. 3) To develop a database that can be used to provide reliable winter wheat regional cultivar recommendations. 4) To provide regional winter wheat field demonstrations. The current contract started in January 1998.

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One soft white and two rust resistant hard red winter wheat lines were registered based on data from these trials.

S94-4 hard red winter wheat was registered as CDC Falcon 1998. CDC Falcon is a high-yielding winter hardy semidwarf. The short, strong straw of CDC Falcon will make it an attractive option for farmers who direct seed and straight-cut harvest. The protein concentration of CDC Falcon has been 0.9 percent higher than that of CDC Kestrel and CDC Harrier. CDC Falcon was rated superior to the checks for both falling number and amylograph peak viscosity in quality evaluations. Lower flour yield is a weakness, but the flour yield of the winter wheat class has been higher than that of competing spring wheat and foreign winter wheat classes. The primary strength of CDC Falcon is stem and leaf rust resistance that is superior to all of the winter wheat cultivars registered for production in western Canada and has been welcomed with great anticipation in the rust hazard area of western Canada. CDC Falcon has been released to SeCan.

S95-4 was registered as CDC Raptor in 1999. CDC Raptor is a high-yielding, winter-hardy, semidwarf hard red winter wheat with a plant height that is intermediate to CDC Falcon and CDC Harrier (other stem rust resistant options). The short, strong straw of CDC Raptor will make it an attractive option for farmers who direct-seed and straight-cut harvest. The protein concentration of CDC Raptor has been 0.5 percent higher than that of CDC Kestrel and CDC Harrier and 0.25 percent lower than CDC Osprey. High grain yield potential and protein concentration combine to give CDC Raptor a grain protein yield that is higher than all of the currently registered cultivars. The primary strength of CDC Raptor is stem and leaf rust resistance that is similar to CDC Falcon and superior to all of the other winter wheat cultivars registered for production in western Canada. CDC Raptor has been released to SeCan.

S86-375 was registered as CDC Ptarmigan 1999. CDC Ptarmigan is a short strawed soft white winter wheat cultivar that represents a new winter wheat quality class for western Canadian farmers. The target production areas for this cultivar are the higher moisture environments of western Canada outside of the primary rust hazard area (similar to the current soft white spring wheat production region). Field trials indicate that the grain yield advantage of CDC Ptarmigan could be as high as 25 percent in the target production area. CDC Ptarmigan has a protein concentration that is 0.07 percent lower than CDC Kestrel and 1.1 percent lower than that of AC Reed (soft white spring wheat cultivar). The Soft White wheat class provides a hereto-unexplored opportunity to capitalize on the high grain yield potential of winter wheat and its associated low protein concentration. Low protein concentration is required for high soft white wheat quality and shifting winter wheat breeding objectives in this direction would turn a long term negative factor (low protein concentration) into a positive advantage for winter wheat. A six-percent yield increase over Red Winter wheat would be required if one assumes similar prices for Soft White Winter and Soft White Spring wheat. Under this scenario, the low protein concentration and high yield potential of CDC Ptarmigan compared to both Red Winter and Soft White Spring wheat should provide an attractive alternative for farmers in the target regions of the western prairies. A three-year interim registration has been supported for this line to allow time for pedigreed seed production, market evaluation, and a CWB Identity Preserved production system to be put into place to accommodate this new winter wheat market class. CDC Ptarmigan is currently being increased under irrigation.

C. TECHNICAL REPORT

This is a continuing project that was started in 1993 and renewed in 1997 and 1998 with the following objectives. 1) To identify winter wheat lines with regional adaptation in Saskatchewan. 2) To conduct final tests required for winter wheat cultivar registration. 3) To develop a database that can be used to provide reliable winter wheat regional cultivar recommendations. 4) To provide regional winter wheat field demonstrations. The current contract started in January 1998.

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Even though these activities are not part of its official strategic responsibilities, Co-operative/Regional winter wheat testing has, by default, been co-ordinated by the Crop Development Centre Conservation Production Systems program since 1989. During this period, the Crop Development Centre has released seven winter wheat cultivars for commercial production in western Canada.

* 1999 - CDC Raptor, CDC Ptarmigan
* 1998 - CDC Falcon
* 1997 - CDC Harrier
* 1995 - CDC Clair, CDC Osprey
* 1991 - CDC Kestrel

Prior to the release of CDC Kestrel, **Norstar** occupied essentially all the winter wheat acres on the Canadian prairies. Norstar was released in 1977 by Agriculture Canada, Lethbridge and soon became the dominant winter wheat cultivar in western Canada. It represented the successful combination of good yield potential and baking quality of an adapted parent (Winalta) with superior winterhardiness of an introduced parent (Alabaskaja). It was particularly well adapted to conditions of drought stress. Its two major weaknesses were susceptibility to lodging and rust. Because of its susceptibility to lodging, farmers in the higher moisture regions of the prairies were forced to restrict their agronomic inputs to yield targets of 45 to 50 bu/acre (approx. three tonnes/ha).

CDC Kestrel was the first semi-dwarf wheat cultivar with good winter hardiness to be released in western Canada. CDC Kestrel also provided the largest increase in winter wheat

cultivar yield potential for the Canadian prairie region since the release of Kharkov 22MC in 1912. It has stem rust tolerance that is superior to Norstar and its shorter, stronger straw made it highly adapted to favourable moisture environments and irrigation. CDC Kestrel replaced Norstar as the dominant winter wheat cultivar in western Canada, claiming most of the acreage outside of southern Alberta and a significant part of the traditional winter wheat production area in southern Alberta by 1998.

The tali plant type of Norstar and its susceptibility to lodging limited the grain yield potential, compromised grain quality due to harvest problems, and limited farmer acceptance of winter wheat in high yield potential environments. The shorter stronger straw of **CDC Kestrel** gave farmers the opportunity to more effectively capitalize on agronomic inputs, such as nitrogen fertilizer. In the higher moisture areas they were able to increase their yield targets from 45 to 50 bu/acre (approx. three tonnes/ha) to 60 to 90 bu/acre (four to six tonnes/ha). As a result, CDC Kestrel became the key to establishing the true potential of properly managed winter wheat in western Canada. A Canadian Wheat Board survey conducted in the fall of 1998 indicated that CDC Kestrel occupied 82 percent of the winter wheat acres in western Canada. The grain protein concentration of CDC Kestrel is lower than the target levels for the Canadian export market. However, a large percentage of the winter wheat grown in the eastern prairies has been going into the domestic feed market where winter wheat has become recognized as a quality product. CDC Kestrel quality types are also in demand by the commercial alcohol production industry. In spite of concerns with grain quality, the Canadian Wheat Board has priced Hard Red Winter Wheat (82 percent CDC Kestrel in 1998) higher than all classes of Canadian Prairie Spring Wheat.

CDC Clair and **CDC Osprey** are tall semi-dwarf cultivars that were released by the Crop Development Centre, University of Saskatchewan in 1995. They combine the high yield potential of CDC Kestrel with improved grain quality. The enthusiasm shown by farmers for CDC Clair has been even more dramatic than for CDC Kestrel and early indications are that CDC Clair will quickly replace CDC Kestrel. The 1999-2000 Canadian Wheat Board Variety Survey indicated that CDC Kestrel and CDC Clair accounted for nearly 90 percent of the winter wheat acres harvested in western Canada. Seed distribution of CDC Osprey, which was made a winter wheat grain quality standard for western Canada in 1998, has been a major disappointment. Distribution rights of CDC Osprey have been transferred from Proven Seeds to Canterra Seeds.

CDC Harrier is a winter-hardy semidwarf with good straw strength and a higher average grain yield than CDC Kestrel. The grain protein concentration of CDC Harrier is similar to CDC Kestrel. CDC Harrier was the first winter wheat cultivar with a high level of stem rust resistance to be registered for production in western Canada. CDC Harrier has performed as expected in 1999 and it has laid claim to the highest commercial winter wheat yields (nearly 100 bu/acre) in the eastern prairies.

CDC Falcon is a short strawed, lodging resistant cultivar with high grain yield potential. Release of CDC Harrier represented a significant step towards achieving target leaf and stem rust objectives for the rust hazard area of western Canada and the release of CDC Falcon realized these objectives. CDC Falcon has given western Canadian farmers the first winter wheat option with leaf and stem rust resistance in the range of adapted spring wheat cultivars. CDC Falcon performed as expected in the hands of seed growers in 1999.

CDC Raptor is a winter-hardy, semidwarf hard red winter wheat with strong straw and good yield potential. The primary advantage of CDC Raptor is stem and leaf rust resistance that is similar to CDC Falcon and superior to all of the other winter wheat cultivars registered for production in western Canada. High grain yield potential and protein concentration combine to give CDC Raptor an average grain protein yield that is higher than all of the currently registered cultivars.

CDC Ptarmigan is a very high yielding, short strawed, soft white winter wheat. It has a very low protein concentration, which is a plus in the soft white wheat market. It has winter hardiness that is similar to Winalta. Field trials indicate that the grain yield advantage of CDC Ptarmigan over other winter wheat cultivars could be as high as 25 percent in the target production area, which is similar to the current soft white spring wheat production region. A three-year interim registration has been supported for CDC Ptarmigan to allow time for pedigreed seed production, market evaluation, and a CWB Identity Preserved production system to be put into place to accommodate this new winter wheat market class in western Canada.

As a group, these cultivars represent the first agronomically adapted, winter hardy, high yielding, semidwarf winter wheat cultivars developed in western Canada, or, for that matter, the world. However, lines with still higher grain yield have been identified in advanced trials. **Morgan**, which is a sister line of CDC Clair, was the top performing entry in Montana interstate trials following the high stress winter of 1996/97, but its yield performance fell back to the center of the pack following the low stress winter of 1997/98. These observations together with the yield advantage shown by CDC Ptarmigan in low moisture environments indicate the yield potential of winter hardy wheat cultivars can be further improved.

MAIN CHARACTERISTICS

	Resistance to*				
Cultivar	Lodging	Winter Damage	Stem Rust	Leaf Rust	Bunt
Norstar	P	G	VP	P	P
CDC Kestrel	G	G	P	P	P
CDC Clair	G	G	P	P	P
CDC Osprey	G	G	P	P	P
CDC Harrier	G	G	G	P	P
CDC Falcon	VG	G	G	G	P
CDC Raptor	VG	G	G	G	P
CDC Ptarmigan	G	F	VP	P	P

* Resistance ratings: VG - Very Good; G - Good; F- Fair; P - Poor; VP - Very Poor.

Winter wheat strains have been identified with superior winter hardiness, greater yield potential, more diverse grain quality, and improved resistance to diseases and insects compared to the cultivars that have been registered for production in western Canada in the 20th century. Successful selection for these traits has established that the necessary genetic resources are available for the creation of better-adapted, more productive cultivars for a wide variety of wheat quality classes. Basic germplasm has been developed, networks have been established, credibility is at an all time high, and new, effective tools are waiting to be used. The opportunity for rapid winter wheat cultivar improvement has never been greater.

D. PERSONNEL - as of June 30, 1999

A list of personnel involved in the project and percentage of their time involved in project:

a) D.B. Fowler	10%	- ADF strategic budget
b) R. Hankey	30%	- Transferred to ADF strategic budget in June 1999
c) G. Schellhorn	10%	- WGRF breeding budget
d) P. Hedlin	75%	- $1,500/month (summer student)
e) K. Kovach	50%	- $1,650/month (summer student)
f) C. Mensah	50%	- $1,875/month (summer student)

E. EQUIPMENT

There have been no equipment purchases from this project.

F. PUBLICATIONS AND PRESENTATIONS

Fowler, D.B. 1998. Progress Report - ADF Project 97000235. Regional Testing and Development of Winter Wheat Cultivars. June 30, 1998.

Fowler, D.B. 1998. Report on the Central Hard Red Winter Wheat Co-operative Tests 1998. 15 pp.

Fowler, D.B. 1998. 1998 Winter Wheat Review for Grain Crops Subcommittee of Sask. Advisory Council on Crops. December 11, 1998.

Fowler, D.B. and F.A. Holm. 1998. Crop Development Centre Conservation Production Systems Annual Report to Saskatchewan Agriculture. 8 pp.

Fowler, D.B. 1998. Progress Report - ADF Project 97000235-87BR. Regional Testing and Development of Winter Wheat Cultivars. Dec. 31 , 1998.

Fowler, D.B. 1999. Crop Development Centre Conservation Production Systems Annual Report to Saskatchewan Agriculture. 5 pp.

Fowler, D.B. 1999. Progress Report - ADF Project 97000235. Regional Testing and Development of Winter Wheat Cultivars. June 30, 1999.

Fowler, D.B. and F.A. Holm. 1999. Crop Development Centre Conservation Production Systems

Annual Report to Saskatchewan Agriculture. 8 pp.
Fowler, D.B. 1999. 1999 Winter Wheat Review for Grain Crops Subcommittee of Sask. Advisory Council on Crops. December 2, 1999.
Fowler, D.B. 1999. Report on the Central Hard Red Winter Wheat Co-operative Tests 1999. 15 pp.
Fowler, D.B. 1999. Report on the Central Hard White Winter Wheat Co-operative Tests 1999. 9 pp.
Fowler, D.B. 1999. Progress Report - ADF Project 97000235. Regional Testing and Development of Winter Wheat Cultivars. Dec. 31, 1999.

G. STATEMENT OF EXPENDITURES

The University of Saskatchewan Business Office will forward a statement of expenditures.

H. PROJECT PHOTOS

None included in this report.

I. ACKNOWLEDGEMENTS

This project gratefully acknowledges the financial support of Saskatchewan Agriculture and Food on official reports.